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## SENSIBILITY TO PAIN.

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The purpose of the following experiments was to test further the relation between sensibility to pain and age, to learn whether mental ability influences this sensibility, and, if possible, to determine the effect of mental fatigue on the threshold of pain.

The instrument used was Dr. Arthur MacDonald's temple algometer.<sup>1</sup> By gently pressing on the temples with the flannel-covered disk at the end of a rod running through a cylinder and connected with a spring in the cylinder, the threshold of pain was determined in grams for each temple. The subject was instructed to say "stop" the moment the pressure felt "the least bit disagreeable."

The two following tables, one for males and the other for females, give the threshold of pain in grams for the right and left temples, as indicated at the top of the third and fourth columns: The first column gives the nearest age of the subjects, and the second the number of subjects whose tests enter into the average.

It will be noticed that the left temple is more sensitive than the right. This agrees with the results already found by Dr. Arthur MacDonald<sup>2</sup> and Miss Carman.<sup>3</sup>

This sensibility to pain decreases with the increase in age until about 18 or 19 years, when it seems to remain nearly stationary, varying slightly with different individuals and hence with different groups. This variation, I think, is due to other causes than age, as I shall show later in this paper.

Females at all ages are, in general, more sensitive to pain than males.

I did not find the "increase of obtuseness to pain from ages 10 to 11" to which Dr. MacDonald calls attention.<sup>2</sup>

In order to find the effect of mental fatigue on sensibility to

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<sup>1</sup> Described in the *Psychological Review*, July, 1898.

The credit for starting this line of research belongs to Dr. Arthur MacDonald, of the Bureau of Education at Washington, and this paper is offered as a contribution to his valuable work.

<sup>2</sup> Further Measurements of Pain. A paper before the American Psychological Association in New York, December, 1898. Also Report of the Commissioner of Education, 1897-98, Vol. I, pp. 1111 and 1113.

<sup>3</sup> *American Journal of Psychology*, April, 1899, p. 393.

TABLE I.  
*Males.*

Near- est Age.	Number of Persons.	Right Temple.	Left Temple.
7	2	875	875
8	2	650	625
9	5	1065	1050
10	8	825	800
11	8	978	940
12	6	1037	1012
13	11	1052	1036
14	5	1450	1450
15	10	1300	1305
16	15	1666	1651
17	12	1735	1729
18	7	2021	1992
19	15	1790	1708
20	15	2136	2188
21	9	1808	1788
22	6	1833	1858
23	5	2260	2140
24	5	1860	1860
25	4	1750	1675
26	1	1650	1650
27	1	1150	1150
31	1	2450	2400
35	1	3600	3600

TABLE II.  
*Females.*

Near- est Age.	Number of Persons.	Right Temple.	Left Temple.
7	1	800	850
8	2	625	600
9	6	850	800
10	5	680	690
11	6	837	879
12	8	881	893
13	7	1115	1065
14	17	1294	1279
15	12	1735	1729
16	11	1302	1293
17	18	1562	1520
18	34	1624	1634
19	29	1700	1698
20	25	1682	1666
21	22	1939	1936
22	16	1834	1775
23	12	1708	1652
24	9	1661	1605
25	4	1437	1450
26	4	2087	2050
27	5	1990	1980
29	1	2750	2750
30	4	1862	1962
31	1	2300	2150
32	1	3000	2950

pain two sets of tests were arranged. The first series was carried out during the middle and last part of the school term, when the pupils were tired from their work, and the second series was taken during the first week after a ten days' vacation, when the pupils were comparatively fresh. The two sets of tests, called in the tables "first test" and "second test," were, in every instance, made on the same pupils. That this may be clear let me refer to Table III. In the upper line are the results from seven children, 10 years of age, whose right temples averaged 839 grams with 800 grams for the left temple in the first test. In the second test, immediately after the vacation, these same children averaged 1,239 grams and 1,192 grams for the respective temples.

The dynamometric test of the right hand, unless the subject was left-handed, taken each time just before the algometer was used, served as a basis for a comparison of the physical condition of each subject at the time of the two tests. A Narragansett dynamometer was used, and the measurements were in kilograms.

The results to which I now desire to call attention are found in Tables III and IV, which follow:

TABLE III.

*Males.*

Nearest Age.	FIRST TEST				SECOND TEST.			
	Number of Persons.	Right Temple.	Left Temple.	Dynamometric test.	Right Temple.	Left Temple.	Dynamometric test.	
10	7	839	800	18.4	1239	1192	17.2	
11	8	987	940	20.2	1337	1156	20.1	
12	5	1055	1025	24.	1650	1595	22.	
13	11	1052	1036	26.7	1286	1236	27.	
14	3	1466	1483	35.3	1491	1441	31.8	
15	7	1432	1439	35.	1628	1560	36.7	
16	10	1602	1582	45.1	1470	1457	40.4	
17	10	1702	1700	46.	1737	1705	49.2	
18	5	1780	1750	50.	1675	1640	51.6	
19	10	1795	1710		1822	1760		
20	10	2180	2188	49.6	2017	1952	51.4	
21	5	1980	1960		1860	1815		
23	5	2260	2140	54.2	2320	2245	58.4	
24	3	1966	1950	60.	1450	1425	57.6	
25	4	1750	1675	59.7	1393	1387	59.5	

TABLE IV.

*Females.*

Nearest Age.	FIRST TEST.				SECOND TEST.			
	Number of Persons.	Right Temple.	Left Temple.	Dynamometric test.	Right Temple.	Left Temple.	Dynamometric test.	
10	7	750	750	17.	987	962	22.	
11	5	825	875	17.4	935	870	18.6	
12	6	895	929	16.6	1220	1187	17.5	
13	6	1152	1127	23.5	1322	1291	24.3	
14	16	1300	1290		1307	1270		
15	9	1511	1505	30.8	1666	1750	25.1	
16	11	1302	1293	27.9	1377	1340	29.4	
17	12	1554	1514	25.8	1616	1562	30.3	
18	22	1560	1573		1710	1669		
19	20	1551	1568	28.9	1763	1723	28.5	
20	19	1627	1621		1536	1485		
21	17	1901	1902	33.1	1766	1717	33.4	
22	8	1643	1625	33.2	1646	1603	31.8	
23	6	1729	1737	31.8	1979	1933	32.1	
24	7	1421	1400	34.8	1960	1892	35.7	
26	2	1800	1750		2050	1937		
27	2	1850	1900	32.	2100	2050	32.5	

An examination of these two tables shows:

1. That sensitiveness to pain varies at different times. It will be noticed, however, that the relation between the sensibility of the two temples remains about the same. The variation is regular. When the sensibility of one temple increases or decreases the other temple varies in the same way. The sensibility of the left temple is always a little more than that of the right.

The cause of this variation is probably to be found, in large part, in the bodily condition and in the degree to which the subject is affected by his bodily condition. In the present instance fatigue resulting from school work was undoubtedly an important factor in causing the variation.

2. Fatigue seems to have more effect on the younger boys and on females. The variation is more constant with these two classes. Their second test shows less sensitiveness in a greater number of cases. This is as might be expected, since the nervous system of children has a freer sway than in those who are older. Inhibitions play a less prominent part in the mental life of children. Hence they are more easily influ-

enced by their physical condition. Probably the same explanation may be made for the greater variation of females. Young men, being stronger physically, would not be so easily fatigued by school work. Table III shows that all the boys from 10 to 14 years were less sensitive to pain after the vacation than during the term's work, while Table IV gives only one group below the age of 20 years in which the girls were not less sensitive to pain after the vacation.

3. The dynamometric tests indicate that the physical strength of the subjects did not vary much when the two tests were made. As might be expected their strength averaged a little more after the vacation, but the difference was slight. It would seem from this that the comparative indifference to pain after vacation is to be accounted for by the increased tone of the body, and especially of the nervous system, rather than by any marked increase in physical strength.

In order to find out whether mental ability has any influence on sensibility to pain the pupils were divided into five groups, (1) very dull, (2) dull, (3) fair, (4) good, and (5) excellent. The advantage of this division over one of two classes, *i. e.*, "dull" and "good" or better, is evident. When we have to decide between "good" and "dull" we put a large number in the "good" group that do not properly belong there. Still we cannot call them "dull." Again "good" does not give us an idea of unusual ability, and so we are certain to put into this group a rather heterogeneous lot of intellects. If, however, we have a "fair" group below the "good" and an "excellent" above, we sift the pupils according to ability much more accurately.

Only those regarded as "dull" or "very dull," on the one hand, and "excellent," on the other, are included in the following estimate. Those designated by their teachers as "fair" or "good" were not considered. In this way a wide difference was made between the ability of those in the two groups.

TABLE V.

DULL.				EXCELLENT.			
Number of Persons.	Ages.	Right Temple.	Left Temple.	Number of Persons.	Ages.	Right Temple.	Left Temple.
Males.							
32	11-24	1849	1826	21	11-26	1641	1576
Females.							
51	11-25	1688	1671	32	11-30	1331	1321

It will be seen from Table V that those of "excellent" ability are much more sensitive to pain than those that are

"dull." Miss Carman<sup>1</sup> also found dull children less sensitive, though Dr. MacDonald says, "there seems to be no necessary relation between intellectual development and pain sensitivity."<sup>2</sup>

The plan of putting all the "dull" pupils into one group, and all the "excellent" ones into the other, as previous investigators seem to have done, is subject to error because the majority of "dull" children is found in those ages in which "excellent" ones are rare, *i. e.*, from 14 to 18 years. The "excellent" pupils, again, are found among those up to 14 years and from 18 years on. As sensitiveness to pain varies with age up to about 18 years it is possible that this age variation might so far affect the variation due to ability as to seriously alter it. In order, as far as possible, to eliminate this error two groups were formed, one of "dull" and the other of "excellent" pupils, and for every "dull" pupil of a given age that entered into the one group an "excellent" one of the same age was placed in the other group. If in any case they could not be paired, the one for which a mate of the other grade of ability could not be found was excluded. To avoid any sort of selection I followed the rule of taking them in order, selecting the first "dull" or "excellent" among those of a given age and the next following of the other grade of ability of the same age. The result is as follows: Males (dull), right temple, 1,629; left temple, 1,618; (excellent), right temple, 1,585; left temple, 1,497. Females (dull), right temple, 1,533; left temple, 1,495; (excellent), right temple, 1,355; left temple, 1,360.

The same difference is evident here as was found in Table V. Those of "excellent" ability are much more sensitive to pain than those that are "dull."

Some thoughts of educational interest suggested by this investigation are:

1. The greater sensitiveness of young children. What has been shown here to be true of pain is also true of reproach and severity in whatever form. Pain is as much a mental as a physiological phenomenon.

2. More attention should be given by teachers to the physical side of education. Everything that lowers the bodily tone should be guarded against. The eye-sight of children, their hearing, food, play, cleanliness and sleep, ought to receive the teacher's attention, and care should be taken not to fatigue them by excessive school work or by keeping them too long at one thing.

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<sup>1</sup> *American Journal of Psychology*, April, 1899, p. 396.

<sup>2</sup> Further Measurements of Pain, December, 1898. Also Report of the Commissioner of Education, 1897-98, Vol. I, p. 1113.

3. The brighter children are more sensitive than the dull. Their nervous system reacts quicker in response to the action of the outside world upon them. Bright children present the difficult educational problems. Their more delicately organized nervous system makes it easy to destroy forever their intellectual possibilities. They need the greatest care and thought, and usually get the least.

4. Fatigue makes the nervous system irritable. When fatigued the brain's reaction is more reflex and less intellectual. The child cannot do his best work, and learns to be satisfied with a poor result. He may gradually accommodate himself to a kind of passive reflex nervous activity when his mind should be alert and discriminating.